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Seasonal Incidence of Insect Pests of Chickpea in Relation to Abiotic Factors

Ankit Singh [a++], Pradeep Kumar [a], B. Gangwar [b#], and Balwant Yadav [c†*]

[a] Department of Entomology, Institute of Agriculture Sciences, Bundelkhand University, Jhansi – 284001, India.
[b] Department of Agronomy, Institute of Agriculture Sciences, Bundelkhand University, Jhansi – 284001, India.
[c] Department of Entomology, Banda University of Agriculture and Technology, Banda- 210001 (U. P.), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study explored the seasonal incidence of Insect pests of Chickpea in relation to abiotic factors. The field experiment was conducted at Research Farm, Institute of Agricultural Sciences, Bundelkhand University, Jhansi during the *Rabi* season 2023-2024 to study the seasonal incidence of insect pests of chickpea. The results revealed that the occurrence of the larval population of *Helicoverpa armigera* starts in the 51st SMW. The peak level was attained in the 3rd SMW. The

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[++] M.Sc. Student;
[#] Professor;
[†] Research Scholar;
**Corresponding author: E-mail: balwant2001yadav@gmail.com;*

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correlation studies revealed the negative with temperature and relative humidity while the positive correlation was found with rainfall between larval population and abiotic factors. The multiple regression explained the effect of abiotic factors on the larval population. The larval population gradually decreased at 10th SMW. Weather parameters and larval population together were responsible for 39% (R2=0.39) during *Rabi* season 2023-2024.

Keywords: Helicoverpa armigera L.; correlation; multiple regression; pest occurrence.

1. INTRODUCTION

Pulses are the dried edible seeds of cultivated plants belonging to the Fabaceae family and food legumes have been grown by farmers to provide nutritive valuable foods for Indian people (Nene, 2006) and also grown worldwide. In India, pulses are known as “poor man’s meat and rich man’s vegetable”. The importance of vegetable protein has been well-recognized throughout the world. To benefit from the malic acid, citric acid, mineral content, and fiber in the leaves all of which have therapeutic value are eaten both raw and cooked. Its grain is a good supply of vitamins, minerals (calcium, phosphorus, iron), fat (4–10%), protein (18– 22%), and carbs (52–70%). The crop is commonly farmed in Bangladesh, Australia, India, Turkey, Pakistan, Iran, Mexico, and Turkey (Yadav et al., 2024). The total amount produced in India climbed from 97.67 lakh tonnes in 2020–21 to 103.46 lakh tonnes in 2022–23. In 2020–2021, the 9.99 million hectares of chickpea-planted land grew dramatically, hitting its highest level in the preceding decade. Likewise, chickpea output (11.91 million tonnes) surpassed the previous 50-year record with productivity of 11.92 q/ha. In 2020–2021, 9.99 million hectares of chickpeas were planted, up from 6.45 million ha. Although pulses are grown all across the nation, the largest shares are produced in M.P. (24%), U.P. (16%), MH (14%), A.P. (10%), Karnataka (7%), and Rajasthan (6%). Approximately 77% of the overall pulse output comes from these states, with the other 23% coming from Gujarat, Chhattisgarh, Bihar, Orissa, and other states. However, chickpea production is not fully achieved a abiotic stress and mid-different biotic stress (Chaturvedi et al., 2018). The pod borer, *Helicoverpa armigera* (Hubner), is a significant insect species that negatively impacts the economy of this crop (Lepidoptera: Noctuidae). This extremely polyphagous insect preys on more than 182 plant species, including commercially important and extensively farmed cotton, maize, tobacco, pigeon pea, chickpea, and tomato crops (War et al., 2024). Reports indicate that the pod borer reduced chickpea yields by 10–60% in typical meteorological conditions and 50–100% in favorable ones, particularly in areas where periods of rain and cloud cover are common during the growing season. According to reports, the pod borer reduces chickpea productivity by 30 to 80 percent in typical meteorological conditions. A single *Helicoverpa armigera* caterpillar may eat 30–40 pods before reaching maturity (Pal et al. 2016). The abiotic factors play a major role in regulation of population of *H. armigera* (Hameed et al., 2015).

2. MATERIALS AND METHODS

The field experiment was conducted at Research Farm, Department of Entomology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi, U. P. during the *Rabi* season of 2024. To determine the seasonal incidence of insect pests of chickpea in relation to abiotic factors, the larval population was recorded randomly selected 10 plants of chickpea at three random places at weekly intervals, from germination to harvesting. The population was correlated with abiotic factors. After distinguishing between the several species, *Helicoverpa armigera* (Hub.) larvae were counted after being shaken down on a large paper sheet from each observation. Weekly observations between 8 and 11 AM were documented.

3. RESULTS AND DISCUSSION

The data on the larval population of *Helicoverpa armigera* L. during the *Rabi* season in 2023-2024 have been presented in Table 1 and Fig. 1. It is evident from Table 1, that the larval activity continued throughout the crop season.

The occurrence of gram pod borer, *Helicoverpa armigera* (H.) in the 2023-24 *Rabi* season commenced from the 51st standard week (December third week) with an average of 0.96 larvae per plant. The larval population increased and gradually reached a peak level of 2.97 no. of larvae/plant at the 3rd standard week (January third week). However, the lowest mean larval population is 1.02 larvae per plant at the 10th SMW (March second week). The abiotic factor

played a key role in the build-up of the larval population. The present findings was similar to Singh et al., (2018) they reported that the infestation of gram pod borer on chickpea initiated during fourth week of December. These findings were also similar to Spoorthi et al., (2017) was noticed that the initial incidence of population at third week of December. Jadhav et al., (2021) also reported that the gram pod borer incidence was started at 51st SMW and attained the peak level at 3rd SMW.

The correlation studies between larval population and weather parameters are given in Table 2. The result revealed that the correlation of larval population of gram pod borer was found to be negative with maximum (r = -0.48), and minimum (r = -0.41) temperatures, and morning and evening relative humidity (r = -0.19, r = -0.32) while a positive correlation was found between rainfall (r = 0.10) and larval population. The present findings are similar to Spoorthi et al., (2017) who described the correlation as negative with relative humidity, and positive with rainfall. Tripathi *et al.*, (2024) also reported that a negative correlation was found between larval population and morning and evening relative humidity.

To evaluate its impact on the larval population of gram pod borer, the multiple regression equation was utilized, which included meteorological characteristics. The model's consideration of weather parameters accounted for 39% of the variation in the larval population, according to the derived R2 value of 0.39. This implies that environmental conditions have a moderate impact on pod borer incidence. Furthermore, the research shows that the larval population would decline by 0.09, 0.05, and 0.01 individuals, respectively, if the maximum temperature dropped by 1°C, the evening relative humidity dropped by 1%, and 1 mm of rainfall fell. These results highlight how weather factors, including temperature, humidity, and rainfall, may affect the population dynamics of gram pod borer.

Table 1. Seasonal incidence of pod borer, *Helicoverpa armigera* L. in chickpea during *Rabi* season 2023-2024

Smw	Period	Temperature (℃)		Relative Humidity (%)		Rainfall (mm)	Larval Population of *H. armigera* L.
		Max.	Min.	Mor.	Eve.		
49	03/12/2023-09/12/2023	24.0	14.7	81.0	41.0	0.00	0.00
50	10/12/2023-16/12/2023	26.8	9.5	83.0	58.0	11.35	0.00
51	17/12/2023-23/12/2023	25.0	8.0	73.0	61.0	10.00	0.96
52	24/12/2023-30/12/2023	26.4	9.2	91.0	72.0	17.60	1.21
01	31/12/2023-06/01/2024	15.7	10.8	92.0	71.0	0.00	1.53
02	07/01/2024-13/01/2024	21.1	8.2	74.0	39.0	0.00	1.76
03	14/01/2024-20/01/2024	14.2	5.4	83.0	41.0	21.50	2.97
04	21/01/2024-27/01/2024	20.8	6.2	76.4	43.0	0.00	2.13
05	28/01/2024-03/02/2024	23.8	10.5	69.7	39.0	0.00	2.33
06	04/02/2024-10/02/2024	21.7	9.1	61.0	34.0	11.35	2.14
07	11/02/2024-17/02/2024	25.7	10.4	65.9	35.6	0.00	1.33
08	18/02/2024-24/02/2024	27.4	13.0	79.9	42.0	0.00	2.34
09	26/02/2024-04/03/2024	26.4	13.8	70.0	56.0	0.00	1.63
10	05/03/2024-11/03/2024	26.4	11.2	72.4	38.0	0.50	1.02

Table 2. Correlation and regression analysis studies between larval population and weather parameters

Larval population	Temperature (℃)		Relative Humidity (%)		Rainfall (mm)
	Max. Temp.	Min. Temp.	Mor. Rh.	Eve. Rh.	
Gram pod borer	-0.48	-0.41	-0.19	-0.32	0.10
Multiple Regression	$Y= 6.23-0.09X_1-0.05X_2-0.01X_3-0.01X_4+0.00076X_5$				0.390

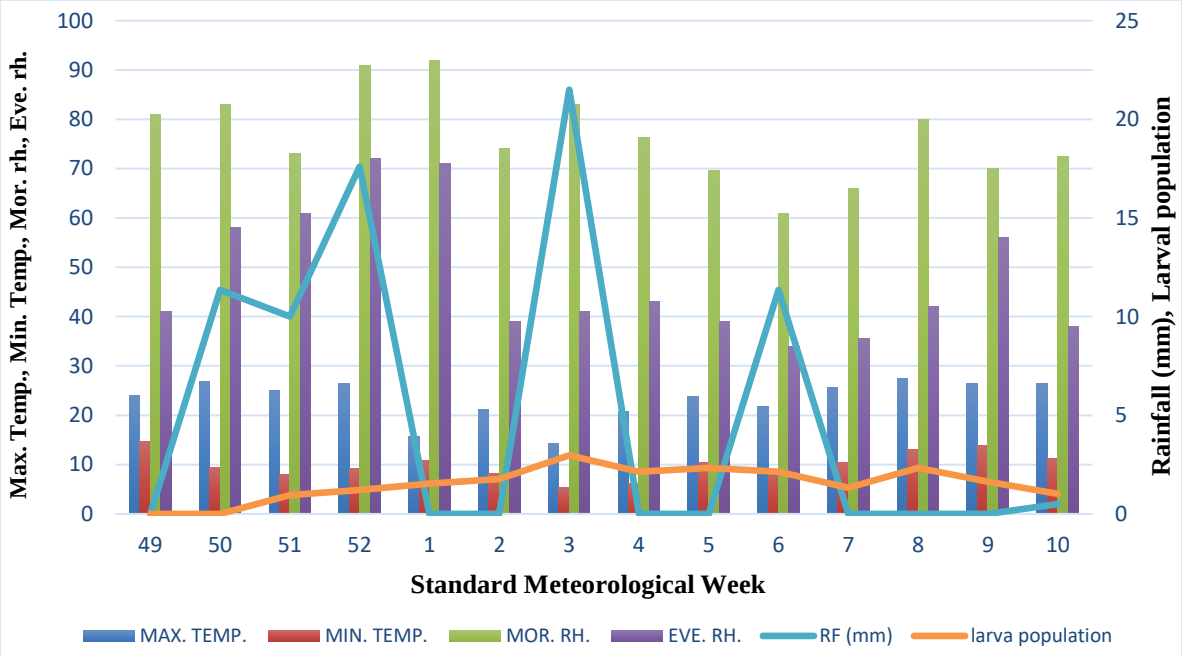

Fig. 1. Seasonal incidence of pod borer, *Helicoverpa armigera* L. in chickpea during *Rabi* season 2023-2024

4. CONCLUSION

The present study revealed that the incidence of *Helicoverpa armigera* in the Bundelkhand region is occurrence from 51st SMW and attained peak larval population at 3rd SMW is influenced by various abiotic factors. The larval population gradually decreased at 10th SMW. Weather parameters and larval population together were responsible for 39% (R^2=0.39) during *Rabi* season 2023-2024.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that No generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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